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Effect of Specific Feedback on Growth Mindset and Achievement

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EFFECT OF SPECIFIC FEEDBACK ON GROWTH MINDSET AND ACHIEVEMENT

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ABSTRACT

Every student has a different mindset, or their own way of viewing challenges and setbacks. The purpose of this study was to determine the effectiveness of a specific feedback intervention on student mindset and achievement in a middle school life science course. Several tests were used to compare the data at the beginning of the school year and at the end of the school year. These tests included mindset, competency in science, attitudes about learning science, and life science content knowledge. The control group was taught by the use of lecture, note-taking, and life science activities. The experimental group was taught using the same instruction, and in addition the students participated in a mindset intervention involving specific, constructive feedback. The intervention was termed growth conferences. There were no significant differences in the pre versus post scores for mindset, competency in science, or attitude towards science. These data suggest that utilizing individual growth conferences for one semester in a middle school life science setting was not effective for creating significant changes in mindset, competency in science, attitude towards science, or life science content knowledge. The control group's GPA did decrease significantly from sixth to seventh grade, while the experimental group's GPA remained the same from sixth to seventh grade. When the gifted class' data were removed from the control group's GPA there was not a significant difference from sixth to seventh grade. This indicated that the students in the control group, mainly the gifted students, needed a mindset intervention, and that the mindset intervention may have prevented the experimental group's GPA from decreasing over the year. There were also data to support that as mindset increased, so did life science content knowledge and performance. If the present study were to be repeated the intervention should be more frequent, perhaps a weekly group intervention, instead of individual conferences. This would allow for the students to experience the intervention for more time throughout one semester or a school year.

INTRODUCTION AND LITERATURE REVIEW

As a middle school science teacher, it's important to know what sets students apart, and what can be done to educate each one of them. They each learn differently, at different rates and they each have different abilities. They all come from different homes, backgrounds, and histories. They all have different social skills. Each student is unique, which calls for unique ways to teach them and to grow their intelligence and abilities. Something that gives insight into how the student views the world, and how they cope with challenges is called mindset (Dweck, 2006).

Intelligence and ability is not something inherent. It can be developed! Carol Dweck has spent three decades of her research career proving this point, and compiled her findings in a book called "Mindset: The New Psychology of Success" (2006). Dweck has also published a plethora of academic papers that back up her influential research (Blackwell et al. 2007, Dweck, 2006, Dweck, 2007, Dweck, 2008, Grant et al. 2003). In a compilation of research called "Mindsets and Math/Science Achievement" from 2008, Dweck states, "Hint: Don't tell your kids that they are smart. More than three decades of research shows that a focus on effort—not intelligence or ability—is key to success in school and in life."

Dweck described two ways to view mindset: fixed mindset and growth mindset. Different mindsets lead to different ways of viewing challenges, obstacles, effort, criticism, and the success of others (Richard, 2007). As a result, those with a fixed mindset may plateau early and achieve less than their full potential. According to Richard (2007), students with fixed mindsets tend to:

- avoid challenges
- give up easily
- see effort as fruitless or worse
- ignore useful negative feedback
- feel threatened by the success of others

Those with a growth mindset reach ever-higher levels of achievement and have a greater sense of free will. According to Richard (2007), students with growth mindsets tend to:

- embrace challenges
- persist in the face of setbacks
- see effort as the path to mastery

- learn from criticism
- find lessons and inspiration from the success of others.

The reason Alfred Binet invented the Intelligence Quotient, IQ, test provides supporting evidence that intelligence can grow and be developed (Siegler, 1992; Dweck, 2006). Many people view the IQ test as a fixed, unchangeable score, but this is not true. Binet used his IQ test to prove that Paris public schools needed to improve educational programs to get students on track (Siegler, 1992; Dweck, 2006). Binet recognized that it is not always the people who start out the smartest who end up the smartest (Siegler, 1992; Dweck, 2006). IQ is affected by a person's genes, biology, cognition, education, and experiences (Flynn, 2013). This has become a popular topic over the years. James Flynn, whose theory was coined the "Flynn Effect", presented his TED talk, "Why our IQ levels are higher than our grandparents'", in February of 2013. He states that there have been "massive IQ gains over time." With each passing generation there is more education, invention, and technology (Flynn, 2013). Changes in education and professions are increasingly more demanding cognitively. We are taking hypothetical situations or theories more seriously now, and using logic to solve moral and world problems (Flynn, 2013). This is a theory of IQ on a very large scale.

Studies have also been done to see if educational interventions can grow intelligence (Aronson, 2007, Blackwell et al. 2007, Cassidy et al. 2011, Dweck, 2008). In a pilot study called, "A Relational Frame Training Intervention to Raise Intelligence Quotients", the experimental group participated in a multiple exemplar, computer based training intervention, while the control group did not (Cassidy et al. 2011). Significant improvements were seen in full-scale IQ scores, or composite scores, for the experimental group. At the end of the pilot study Cassidy et al. state, "There is a great deal yet to be learned about the process and outcome of relational multiple-exemplar training, but enough studies exist to demonstrate that it can develop relational skills and as a result impact important psychological processes" (Cassidy et al. 2011). More studies like this need to be conducted for the conclusion to be firm.

This information can help to develop more interventions that increase intellectual skills, and raise questions similar to the present study: "Can an intervention focusing on specific, constructive feedback have a positive impact on mindset and achievement?" and "Do students who have a growth mindset achieve higher on academic tasks?"

There is a multitude of evidence that students' mindsets play a key role in their science achievement (Dweck, 2008, Grant et al. 2003, Dweck, 2008, Aronson et al. 2002).

> Students who believe that intelligence or math and science ability is simply a fixed trait (a fixed mindset) are at a significant disadvantage compared to students who believe that their abilities can be developed (a growth mindset). Moreover, research is showing that these mindsets can play an important role in the relative underachievement of women and minorities in math and science (Dweck, 2008).

In "Mindsets and Math/Science Achievement", Dweck (2008) reviewed research that showed:

- Mindsets can predict math and science achievement over time.
- Mindsets can contribute to math and science achievement discrepancies for women and minorities.
- Interventions that change mindsets can boost achievement and reduce achievement discrepancies.
- Educators play a key role in shaping students' mindsets.

In Study 1 of "Implicit Theories of Intelligence Predict Achievement Across an Adolescent Transition: A Longitudinal Study and an Intervention", Blackwell at al. (2007) followed students across the challenging transition to 7th grade. At the beginning of the year, their mindsets were assessed, along with other motivation-relevant variables, and then their math grades were monitored over two years (Blackwell et al. 2007). All of the students started out with the same grades, because elementary school had not been as much of a challenge. Over time, the math grades of the students with a fixed mindset and students with a growth mindset had jumped apart and they continued to diverge. The students with fixed mindsets grades decreased, while the students with growth mindsets increased (Blackwell et al. 2007). Study 2, involving a different set of students at a different school, proved that teaching 7th graders a growth mindset through workshops increases mathematics achievement (Blackwell et al. 2007, Dweck, 2008). The students were taught that the brain is like a muscle that can grow stronger and make new connections as it is challenged. Dweck concludes, "When students believe that their intelligence can increase they orient toward doing just that, displaying an emphasis on learning, effort, and persistence in the face of obstacles (Dweck, 2008)."

In 2003, Grant and Dweck examined college students taking pre-med organic chemistry. They focused on students' learning goals versus how much they were concerned with validating their intelligence (Grant et al. 2003). They found that a growth orientation predicted higher final grades in the organic chemistry course, using math SAT scores as a control. The growth-oriented students used deeper learning strategies, such as making connections between the concepts instead of memorization. They also found that a fixed mindset predicted a failure to recover from an initial poor grade, and a growth mindset predicted successful recovery. They looked further into the data, and found that among students who held a fixed mindset, males outperformed females in final grades; however, among students who held a growth mindset, females slightly outperformed males (Grant et al. 2003).

Aronson (2007) demonstrated that mindsets could play a large role in minority students' underperformance on standardized tests. In these studies, Aronson administered the verbal portion of the medical boards (the MCAT) to black and Latino students who wished to go to medical school. The students were given one of two instructions. Half received fixed mindset instructions, in which they were told that the test measured a stable underlying ability. The other half was told that the test measured a set of skills that could be improved with practice. The performance of the two groups was highly discrepant, with those who received the growth mindset instructions getting significantly more items correct (Aronson, 2007).

Aronson et al. (2002) used a workshop to teach students at Stanford University a growth mindset. To shore up their understanding of the growth mindset, the students also tutored younger students within a growth mindset framework. There were two control groups. One received a comparable workshop and tutoring experience but organized around the idea that there are many different kinds of intelligence and that one should not be discouraged if one does poorly in a given area (Aronson et al. 2002). The other control group received no treatment. At the end of the semester, the students—both black and white—in the growth mindset workshop had earned significantly higher grade point averages than those in the control groups (the control groups did not differ from each other). Although the black and white students in the growth mindset group showed similar advantages over the control group in terms of grade point average, the black students showed even larger increases than did the white students in their enjoyment of academic work and in their valuing of school (Aronson, et al. 2002).

During the present study, the teacher used process praise to attempt to boost the students' mindsets. Research has shown that giving students praise for their intelligence, as opposed to praise for the process makes students think that their abilities are fixed, makes them avoid challenging tasks (so they can keep looking

intelligent), makes them lose confidence and motivation when the task becomes hard, impairs their performance on and after difficult problems, and leads them to lie about their scores afterwards (Dweck, 2008). Process praise (such as praise for effort or strategy), in contrast, leads students to seek and thrive on challenges (Dweck, 2008). Process praise includes feedback about strategies, effort, perseverance, challenge-seeking, and improvement as opposed to person praise/feedback, which refers to the intelligence or talents of the student, or outcome praise/feedback, which puts the focus on the final product (Cimpian et al. 2007). Below are examples of process praise/feedback:

> "I like the way you tried all kinds of strategies on that math problem until you finally got it. You thought of a lot of different ways to do it and found the one that worked!"
>
> "I like that you took on that challenging project for your science class. It will take a lot of work—doing the research, designing the apparatus, buying the parts, and building it. Boy, you're going to learn a lot of great things."

It is very important to give process feedback to the most able students, who as suggested above, have often coasted along, gotten good grades, and been praised for their intelligence (Cimpian et al. 2007). These may be the very students who opt out when the work becomes more difficult (Cimpian et al. 2007).

Cognitive wrappers were used in the present study as a tool to guide process feedback. A cognitive wrapper is an activity that surrounds a pre-existing learning or assessment task and fosters students' metacognition. A self-monitoring wrapper can be built around any pre-existing part of a course. Wrappers are time efficient, because the students have already done the task, and the wrapper just adds on a few minutes. Also, students are self-monitoring in the context where it is needed, feedback on accuracy is built in, and wrapper support can be gradually faded. A wrapper is a very short survey given to students along with their exam feedback (Bowen, 2013). Wrappers consist of four parts:

- Rationale to help the student improve.
- Reflection on how the student prepared for the exam.
- Comparison to see what kinds of mistakes the student made.
- Adjustment to explain how the student will prepare differently next time (Bowen, 2013).

Upon returning a graded exam, students complete a reflection sheet in class where they report study strategies, analyze errors, and identify new approaches. When students receive their exam back, they often focus on only one thing: the score. The students are missing out on a valuable learning opportunity. Reviewing their study

strategies and learning processes (metacognition) leads to great improvements. Lovett (2013) developed exam wrappers *(*Appendix B*),* which are structured reflection activities that prompt students to practice key metacognitive skills after they receive their exam grades. Three kinds of questions are asked:

1.) how they prepared

2.) what kinds of errors they made on the exam

3.) what they might do differently to prepare for the next exam (Lovett, 2013).

These kinds of questions lead to students asking, "What did I do to study for this exam?" and "Where did I have difficulties on the exam?" or stating, "Next time, I should solve more practice problems so I know better how to set things up (Lovett, 2013)." This information gives the teacher a lot of specific information to help the student improve. It also gives better information on student performance on learning objectives, and helps them to adjust their teaching to address any unmet needs (Lovett, 2013). The steps are to rationalize, reflect, compare, and adjust for the students and the teacher (Lovett, 2013).

There are two types of cognitive wrappers used as tools for the present study: exam wrappers and preparedness wrappers. The exam wrappers facilitate the instructor's support of their students' metacognitive development, bringing to light that intelligence is not fixed, but can grow. The time used to focus the students now will carry them through college and beyond. Students will become more familiar with their strengths and weaknesses in cognition, appropriate learning goals, and planning their approach to a learning task, monitoring progress, evaluating performance, and reflecting on what did and did not work to adjust for the next exam (Lovett, 2013). Individualized feedback is ideal for refining students' skills. To create diversity in metacognition, teachers can use preparedness wrappers (Appendix B) before each individual conference. Preparedness wrappers are adapted slightly for students to reflect on how they spend their time preparing for class. The student is asked to try to improve on:

- Time management
- Sharpening skills
- Specific habits or new habits
- Participating more

This provides the teacher with help to support learning, preparation, and growth for each preceding class. Wrappers are easily adapted and easily repeatable, making researching their effectiveness convenient for teachers (Lovett, 2013).

The goal of the present study was to see if the teacher could foster an increase in growth mindset and academic achievement in 7th grade life science students using cognitive wrappers to guide specific and constructive feedback during individual growth conferences.

MATERIALS AND METHODS

The purpose of this study was to determine the effect of specific feedback during growth conferences on the students' mindset and academic achievement. The study was performed at S. J. Welsh Middle School in Lake Charles, Louisiana. S. J. Welsh is one of the largest middle schools in Louisiana, with 1,194 students. It is usually ranked 1 or 2 in the state each school year in terms of size.

The gender breakdown at S. J. Welsh Middle School is close to equal at 50.9 % male and 49.1 % female. There are more Caucasian (54.3 %) students than African American (38.5 %), Hispanic (2.1%), Asian (4.7 %), and Native American/Alaskan Native (0.3%) students. Students offered free/reduced lunch (50.6 %) and students who pay full price (49.4 %) are close to being equal. Sixth graders make up 35.3 % of the population, seventh graders make up 32.6 % of the population, and eight graders make up 32.2 % of the population (Table 1).

Table 1: The demographic breakdown of S. J. Welsh Middle School student population, 2014-2015.

Demographics	N=1194				
Gender	50.9 % Male	49.1 % Female			
Race	54.3 % Caucasian	38.5 % African American	2.1 % Hispanic	4.7 % Asian	0.3% Native American/ Alaskan Native
Lunch	50. 6 % Free/Reduced Lunch	49.4 % Full Price			
Grade	35.3 % 6th	32.6 % 7th	32.2 % 8th		

The study group consisted of all seventh graders. The experimental group consisted of three regular classes, and the control group consisted of two regular classes and one gifted class. The experimental group made up 36.8 % (43 students) of the sample, and the control group made up 63.2 % of the sample (74 students) (Table 2). The experimental group had an equal breakdown of male and female students. The control group had almost two times more males than females (Table 2). With the gifted class removed from the control group, there were 49 students with 26 males and 23 females. Removing the gifted class changes the percentages to 46.7 % of the sample for the experimental group and 53.2 % of the sample for the control group.

Table 2: Gender breakdown of study participants.

Group	Total	Males	Females
Experimental	43	21 (48.9 %)	22 (51.2 %)
Control	74	49 (66.2 %)	25 (33.8 %)
Control without Gifted Class	49	26 (53.1 %)	23 (46.9 %)

The demographic breakdown of the entire sample consisted of slightly more Caucasian (52.1 %) than African American students (43.6 %), a small percentage consisted of Hispanic students (2.6 %) and an even smaller percentage consisted of Native American/Alaskan Natives (1.7 %) (Table 3). Table 3 also breaks down the demographics for the experimental group, the control group, and the control group with the gifted class removed. The number of students in the entire sample receiving free/reduced lunch (48.3 %) and students paying full price (51.7 %) were close to being equal. These students range in age from 12-14.

Table 3: Demographic breakdown of the entire sample, experimental and control groups.

Demographics	Caucasian	African American	Hispanic	Native American/Alaskan Native
Entire Sample (117)	52.1 % (61)	43.6 % (51)	2.6 % (3)	1.7 % (2)
Experimental Group (43)	39.5 % (17)	53.5 % (23)	2.3 % (1)	4.7 % (2)
Control Group (74)	60.0 % (44)	37.3 % (28)	2.7 % (2)	0 % (0)
Control Group without Gifted Class (49)	49.0 % (24)	49.0 % (24)	2.0 % (1)	0 % (0)

The school used a traditional schedule, where students have seven different classes each day. Thirty minutes of extra time was fitted in between the second and third classes for Colt Co-Op. The purpose of Colt Co-Op was for teachers to give students extra assistance. The school granted me permission to use the 30 minutes each day to meet with students for this study.

The students were told they were a part of the study and they could opt out at any time without academic consequences. Fixed and growth mindsets were taught to the experimental group in a short lesson at the beginning of the study. Instead of being taught about mindsets, the control group completed their regular daily routine, a life science warm up. The experimental group participated in individual conferences while the control group did not. Each student in the experimental group met with the teacher three times during the semester. First, third, and seventh hour participated in individual growth conferences, from August to January. These students received extra one-on-one attention, while fourth, fifth, and sixth hour did not participate in individual growth conferences or Colt Co-Op. Sixth hour was the gifted class. Other than the short mindset lesson and the growth conferences, the control group received the same treatment as the experimental group. Each group was taught the same life science concepts, at the same rate, using the same materials and resources. Each group was held equally accountable by having the same

number of total possible points for each nine weeks. They had the same number of tests, grades, and homework assignments.

The growth conferences consisted of reviewing cognitive wrappers to assist in giving specific feedback for each unit test and for each students'ongoing class preparation (Appendix B). After each exam, students' completed a test wrapper, which broke down how they prepared for the test, the mistakes they made, their trouble areas, and what they could do to improve. The students then scheduled a five to ten minute conference with the teacher. The students also filled in preparedness wrappers, twice a month, that broke down how prepared they had been for class. Cognitive wrappers provided structure and consistent information for the conferences and feedback. Before the next exam, the sheets were returned to students for review and to use as a basis for making a study plan.

Cognitive wrappers guided metacognition; the students thought about their learning methods, and set new goals for improvement. The students used metacognition to give themselves specific feedback, and in turn the teacher used the information to give each student specific feedback (Bowen, 2013). The students brought the completed cognitive wrappers to the growth conferences. I discussed three areas with each student in the treatment group where the student was lacking, three areas where the student was excelling, and three areas where they could do more to grow as a student. The conferences did not focus on content; they were not tutoring sessions, the focus was on reinforcement to improve.

Examples of what was discussed included:

- Submitting assignments on time.
- Studying more for tests.
- Study skills.
- Preparedness for class.
- Making up past assignments.
- Submitting new classwork.
- Submitting homework on time.
- Being on time to class.
- Averaging test scores.
- Individual test scores.

- Paying attention.
- Seeking extra help.

This study measured 7th grade life science students in a variety of ways. Data were collected from a mindset quiz, a Science Attitude Survey, a Competency in Science Survey, district checkpoint tests, and the Louisiana iLEAP (Table 4):

Table 4: Instruments used for the study, appendix each is located in, and a reference for each.

Instruments Used	Appendix	Reference
Mindset Quiz	A	McKenzie, 2013
Attitude Survey	C	Paciorek, 1997
Competency in Science Survey	C	Bourdeau et al. 2009
District Checkpoints	Not included.	Calcasieu Parish School Board
Louisiana iLEAP	D	Louisiana Department of Education End-of-Year Assessments

The mindset quiz was a list of 20 statements, some of which are classified as fixed, and some of which are classified as growth (Appendix A). Students had to decide whether they strongly agree, agree, disagree, or strongly disagree with the statements. For example, "Your intelligence is something very basic about you that you can't change very much," is a fixed mindset statement, and, "An important reason why I do my school work is that I like to learn new things," is a growth mindset statement (McKenzie, 2013). The mindset quizzes were scored using the scale:

60-45 points= strong growth mindset

44-34 points=growth mindset with some fixed ideas

33-21 points= fixed mindset with some growth ideas

20-0 points=strong fixed mindset

The Science Attitude Survey (Appendix C) was adapted from the Mathematics and Science Attitude Inventory (Paciorek, 1997). The data collected were quantitative pre and posttests and were self-reported during class. The Flesch-Kinaid formula that uses total words, total sentences, and total syllables to calculate the grade level was used to indicate the readability level of the text. This formula also indicates how many years of school a student should have completed to understand the text. The survey is a Flesch-Kinaid grade level 5, meaning a 5th

grader should be able to read it (Paciorek, 1997). The instrument was developed to measure attitudes in science for high school and college girls (Paciorek, 1997), but was used in this study for seventh graders. The survey consists of 12 closed-ended, four point Likert scale questions. The ratings sum together to equal a range of scores from 0 to 36. Higher scores indicate a greater interest in science (Paciorek, 1997).

The Competency in Science Survey (Appendix C) was adapted from the Science Process Skills Inventory. The data collected were quantitative pre and posttests and were self-reported during class (Bourdeau et al. 2009). The survey is a Flesch-Kinaid grade level 3.4, meaning a third grader should be able to read it. The instrument was developed to measure the ability to practice the full cycle of steps in the scientific inquiry process. The inventory measured science process skills, not science content knowledge (Bourdeau et al. 2009). The survey is appropriate for measurement in programs that emphasize the process of science learning along with content. The survey consists of 11 closed-ended, four point Likert scale questions. Higher ratings indicate greater competency in science. Item ratings are summed together to equal a range of scores from 0 to 33 (Bourdeau et al. 2009).

Table 5: District checkpoint dates and number of multiple-choice questions on each test.

Checkpoint	Date Given	# of MC Questions
Pre Test	August 29th, 2014	35
1	October 20th, 2014	10
2	December 17th, 2014	21
3	March 3rd, 2015	32
Post Test	April 29th, 2015	35

The Science Coordinator for Calcasieu Parish School Board developed district checkpoints using Scantron's test bank. The checkpoints that were used covered Unit 1 Scientific Method, Unit 2 Plant and Animal Cells, Unit 3 Living Organisms, Unit 4 Ecology, Unit 5 Balance within Ecosystems, Unit 6 Reproduction and Heredity, Unit 7 Health and Diseases, and Unit 8 Food Webs and Cycles. Examples of the questions were excluded from the appendices for copyright reasons. These tests were multiple-choice and varied in numbers of questions. The pre-test covered all units, checkpoint 1 covered Units 1, 2 and part of Unit 3, checkpoint 2 covered Units 1, 2, 3 and 4, and checkpoint 3 covered Units 1, 2, 3, 4, 5 and 6, and the posttest covered all units. The pretest was given August 29th, 2014. Checkpoint 1 was given October 20th, 2014, Checkpoint 2 was given December 17th, 2014,

Checkpoint 3 was given March 3rd, 2015, and the posttest was given April 29th, 2015. Checkpoint 3 and the posttest were given three and four months after the study ended. Important district checkpoint details are found in Table 5.

The Louisiana grade 7 iLEAP measured the knowledge and skills students should have mastered during the 7th grade life science course. The test covered all of the units taught during the school year (Appendix D). It consisted of 54 multiple-choice questions, and one extended response question. The iLEAP was administered April 14th, 2015. The iLEAP was completed four months after the study ended. Information on the Louisiana iLeap can be found on the Louisiana Believes (http://www.louisianabelieves.com/docs/assessment-2013-2014/2013-2014-science-standards-and-assessment-guidance.pdf?sfvrsn=10).

The students were scored based on these ranges:

Advanced: 388-500

Mastery: 348- 387

Basic: 302-347

Approaching Basic: 259-301

Unsatisfactory: 100-258

A GraphPad statistical program, Prism, was used to analyze the data. Students with missing data were removed from the sample. Unpaired t tests were utilized when comparing the pre data for the control and experimental groups, and the post data for the control and experimental groups. Paired t tests were utilized when comparing the pre and post data for the students in the control and experimental groups. Pearson r tests were used to find correlations between post mindset and 6th grade GPA, 2015 iLeap, and all of the checkpoints.

This study was approved by the LSU Institutional Review Board (IRB# #8818, Appendix E). The parents filled out and turned in a consent form (Appendix F), and the students filled out and turned in an assent form (Appendix G).

DATA ANALYSIS AND RESULTS

Pre mindset quiz scores for the control and experimental group were analyzed and there was no difference between the mean pre mindset quiz for the control (40.74) and experimental groups (39.32) (unpaired t test, p=0.4160) (Table 6). Pre Science Attitude Surveys for the control group (23.05) and experimental group (21.27) showed no significant difference (unpaired t test, p=0.2364) (Table 6). Pre Competency in Science Surveys also revealed no significant difference between the control (20.24) and experimental group (19.64) (unpaired t test, p=0.6876) (Table 6).

Pre district checkpoint test scores of the control group were significantly higher than the experimental group (52.64 versus 39.43) (unpaired t test, p=0.0007) (Table 6). Scores for the 6^{th} grade iLEAP (332.7 versus 291.1) (unpaired t test, p=0.0014) (Table 6) and 6^{th} grade GPA (3.384 versus 2.917) (unpaired t test, p=0.0085) (Table 6) were significantly higher for the control group to the the experimental group.

There was not a significant difference between the mean post mindset quiz scores for the control (39.31) and the experimental group (37.96) (unpaired t test, p=0.5387) (Table 6). There was not a significant difference between the mean post Science Attitude Surveys for the control group (24.52) and the experimental group (22.40) (unpaired t test, p=0.1154) (Table 6). Post Competency in Science Surveys were not significantly different for the control group (22.10) and the experimental group (21.84) (unpaired t test, p=0.8593) (Table 6).

Post district checkpoint scores of the control group were significantly higher than the experimental group (79.52 versus 67.20) (unpaired t test, p=0.0011) (Table 6). 2015 iLEAP scores were significantly higher for the control group than the experimental group (346.5 versus 305.9) (unpaired t test, p=0.0003) (Table 6). 7^{th} grade GPA scores were not significantly higher for the control group than the experimental group (3.191 versus 2.918) (unpaired t test, p=0.0806) (Table 6).

There was not a significant difference between the pre (39.32) and post (37.96) mindset quizzes for the experimental group (paired t test, p= 0.3903) (Table 6). There was no significant difference between pre (21.72) and post (22.40) Science Attitude Surveys for the experimental group (paired t test, p=0.5533) (Table 6). There was not a significant difference between pre (19.64) and post (21.84) Competency in Science Surveys for the experimental group (paired t test, p=0.0675) (Table 6). There was not a significant difference between the 2014 (291.2) and 2015 (305.9) iLEAP for the experimental group (paired t test, p=0.0917) (Table 6). There was not a significant difference

between the 2014 6th grade (2.971) and 2015 7th grade (2.918) GPA for the experimental group (paired t test, p= 0.5791) (Table 6).

There was a significant difference between the 2014 6th grade (3.384) and 2015 7th grade (3.191) GPA for the control group (paired t test, p= 0.0003) (Table 6), where the 7th grade GPA was significantly lower than the 6th grade GPA.

Table 6: Mean scores and standard deviation for pre and post instruments for control and experimental groups.

Instruments	Pre	Pre	Post	Post
	Control	Experimental	Control	Experimental
Mindset Quiz	40.74 ± 6.305	39.32 ± 7.712	39.31 ± 8.957	37.96 ± 8.080
Science Attitude Survey	23.05 ± 4.747	21.72 ± 3.725	24.52 ± 5.501	22.40 ± 2.848
Competency in Science Survey	20.24 ± 6.362	19.64 ± 4.889	22.10 ± 5.839	21.84 ± 5.390
District Checkpoint	52.64 ± 16.23*	39.43 ± 11.70	79.52 ± 15.04*	67.20 ± 12.95
iLEAP**	332.7 ± 45.75*	291.1 ± 54.96	346.5 ± 43.52*	305.9 ± 40.93
GPA**	3.384 ± 0.5177*	2.971 ± 0.7246	3.191 ± 0.5740	2.918 ± 0.6622

*Indicates instruments that were significantly higher when comparing pretests for the control and experimental groups and posttests for the control and experimental groups (t-test, $p < 0.05$).
**Indicates that the "pre" iLEAP and GPA were from the end of the 6th grade 2013-2014 school year.

In an effort to determine if the inclusion of one gifted section in the control group was responsible for the significant differences in control versus treatment comparisons of the pre and post iLEAP and GPA results the gifted section was removed from the data and then the results were reanalyzed (Table 7). There was no difference between 2014 iLEAP (300.1 versus 291.1) (unpaired t test, p= 0.4887), and 2015 iLEAP (318.7 versus 305.9) (unpaired t test, p= 0.2449) between the control group and the experimental group, when the gifted class data were removed from the iLEAP data (Table 7). There was no difference between 6th grade GPA (3.163 versus 2.971) (unpaired t test, p= 0.3039) and 7th grade GPA (3.021 versus 2.918) (unpaired t test, p=0.5723) for the control group and the experimental group, when the gifted class data were removed from the data (Table 7).

The mindset quiz, Science Attitude Survey, Competency in Science Survey, and district checkpoints were also reanalyzed without the gifted section data. There were no significant differences between the pre mindset quiz (40.87 versus 39.32), pre Science Attitude Survey (21.61 versus 21.72), pre Competency in Science Survey (17.96 versus 16.94), or the pre district checkpoint (43.71 versus 49.43) for the control versus experimental group (unpaired t tests, p=0.4794, p=0.9248, p=0.2996, p=0.2180, respectively) (Table 7). There were no significant differences between the post mindset quiz (37.22 versus 37.96), post Science Attitude Survey (23.09 versus 22.40), post

Competency in Science Survey (20.43 versus 21.84), or the post district checkpoint (71.06 versus 67.20) for the control versus experimental group (unpaired t tests, p=0.7801, p=0.6125, p=0.3910, p=0.3352, respectively) (Table 7).

There was not a significant difference between the 2014 6th grade (3.163) and 2015 7th grade (3.021) GPA for the control group (paired t test, p= 0.0502) when the gifted class was removed from the data (Table 6).

Table 7: Mean scores and standard deviation for pre and post instruments for control and experimental groups with gifted class data removed.

Instruments	Pre	Pre	Post	Post
	Control	Experimental	Control	Experimental
Mindset Quiz	40.87 ± 7.319	39.32 ± 7.712	37.22 ± 10.19	37.96 ± 8.080
Science Attitude Survey	21.61 ± 4.398	21.72 ± 3.725	23.09 ± 4.451	22.40 ± 2.848
Competency in Science Survey	17.96 ± 6.197	19.64 ± 4.889	20.43 ± 5.853	21.84 ± 5.390
District Checkpoint	43.71±12.04	39.43 ± 11.70	71.06±14.51	67.20 ± 12.95
iLEAP	300.1± 30.26	291.1±54.96	318.7 ± 33.72	305.9 ± 40.93
GPA	3.163 ± 0.5295	2.971 ± 0.7246	3.021 ± 0.5828	2.918 ± 0.6622

There was a significant difference between pre checkpoint (unpaired t test, p= 0.0007), checkpoint 1 (unpaired t test, p= 0.0033), checkpoint 2 (unpaired t test, p= 0.0024), checkpoint 3 (unpaired t test, p= 0.0010), and post checkpoint scores (unpaired t test, p= 0.0011) between the control group and the experimental group (Table 8). The control group means were higher throughout, but the increases from pre to posttest for the control and experimental group data were the same amount (difference of 26.88 and 27.77, control, experimental respectively) (Table 8).

Table 8: District checkpoint tests results (mean ± standard deviation) for the study groups.

	Pre Checkpoint	Checkpoint 1	Checkpoint 2	Checkpoint 3	Post Checkpoint
Control Group	52.64 ± 16.23	74.76 ± 18.11	70.98 ± 22.75	65.45 ± 18.78	79.52 ± 15.04
Experimental Group	39.43 ± 11.70	60.00 ± 20.82	53.91 ± 18.78	49.44 ± 17.91	67.20 ± 12.95

There was not a significant difference between pre checkpoint (unpaired t test, p= 0.2180), checkpoint 1 (unpaired t test, p= 0.3521), checkpoint 2 (unpaired t test, p= 0.5270), checkpoint 3 (unpaired t test, p= 0.3532), or post checkpoint scores (unpaired t test, p= 0.3352) between the control group and the experimental group when the gifted class data were removed from the checkpoint data (Table 9). The control group means were higher

throughout, but the increases from pre to posttest for the control and experimental group data were the same amount (difference of 27.35 and 27.77, control, experimental respectively) (Table 9).

Table 9: District checkpoint tests results (mean ± standard deviation) for the study groups with gifted class data removed.

	Pre Checkpoint	Checkpoint 1	Checkpoint 2	Checkpoint 3	Post Checkpoint
Control Group	43.71 ± 12.04	65.22 ± 17.29	57.57 ± 21.01	54.15 ± 16.77	71.06 ± 14.51
Experimental Group	39.43 ± 11.70	60.00 ± 20.82	53.91 ± 18.87	49.44 ± 17.91	67.20 ± 12.95

More students in the experimental group (50.00 %) and the control group (60.00 %) had mindset scores that decreased rather than increased (42.86 % for experimental and 40.00 % for control) on the mindset quiz from pre to post testing (Table 10). The control group had a small percentage of students (7.1429 %) whose mindset scores stayed the same. For the entire sample, 53.73 % of the students had mindset scores that decreased from pre to post quiz, and 41.79 % had mindset scores that increased (Table 10).

Table 10: Percentage of students in the control group and experimental group that increased, stayed the same, or decreased on the mindset quiz. Raw numbers for each group, as well as the total percentage and total numbers are shown.

Mindset Quiz Scores	% of Students that Increased	% of Students that Stayed the Same	% of Students that Decreased
Control Group	42.86 % (18/42)	7.1429 % (3/42)	50.00 % (21/42)
Experimental Group	40.00 % (10/25)	0.000 % (0/25)	60.00 % (15/25)
Total	41.79 % (28/67)	4.478 % (3/67)	53.73 % (36/67)

Table 11: Number of students whose mindset quiz score grew four points or more, including the category they started in and the category to which they were moved.

Experimental group mindset categories and score increase. (Total 7)		Control group mindset categories and score increase. (Total 11)	
Strong growth mindset.	47-51	Strong growth mindset.	45-51
Growth with some fixed ideas to strong growth mindset.	33-46, 39-52, 39-46	Growth with some fixed ideas to strong growth mindset.	40-46, 46-51, 36-45, 38-47, 35-50, 42-57, 39-46, 40-46
Growth mindset with fixed ideas.	39-44, 36-40	Growth mindset with some fixed ideas.	34-38
Fixed mindset with some growth ideas.	23-30	Fixed mindset with some growth ideas to growth mindset with some fixed ideas.	32-39

There were a total of seven students in the experimental group whose mindset quiz scores increased four points or more from pre to post testing. There were a total of eleven students in the control group whose mindset quiz scores increased four points or more from pre to post testing (Table 11). Five of the students included from the control group were from the gifted classes.

In addition to looking at changes in mindset, I also analyzed the relationship between mindset and performance. There was correlation between mindset and 6th grade GPA, 7th grade GPA, 2014 iLeap, 2015 iLeap, checkpoint 1, checkpoint 2, checkpoint 3, and the post checkpoint scores (Pearson r, p=0.0134, p=0.0203, p= 0.0310, p=0.0179, p=0.0046, p=0.0002, p=0.0054, and p=0.0224, respectively) (Figure 1, Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, Figure 8 respectively). As mindset scores increased (became more growth-like) GPA, iLEAP scores, checkpoint 1, checkpoint 2, checkpoint 3, and the post checkpoint scores increased. There was no correlation between pre mindset and pre checkpoint scores (Pearson r, p=0.0881) (Figure 9).

Mindset Quiz Ranges:
Strong Growth Mindset = 60-45 points
Growth Mindset with some Fixed ideas = 44-34 points
Fixed Mindset with some Growth ideas= 33-21 points
Strong Fixed Mindset= 20-0 points

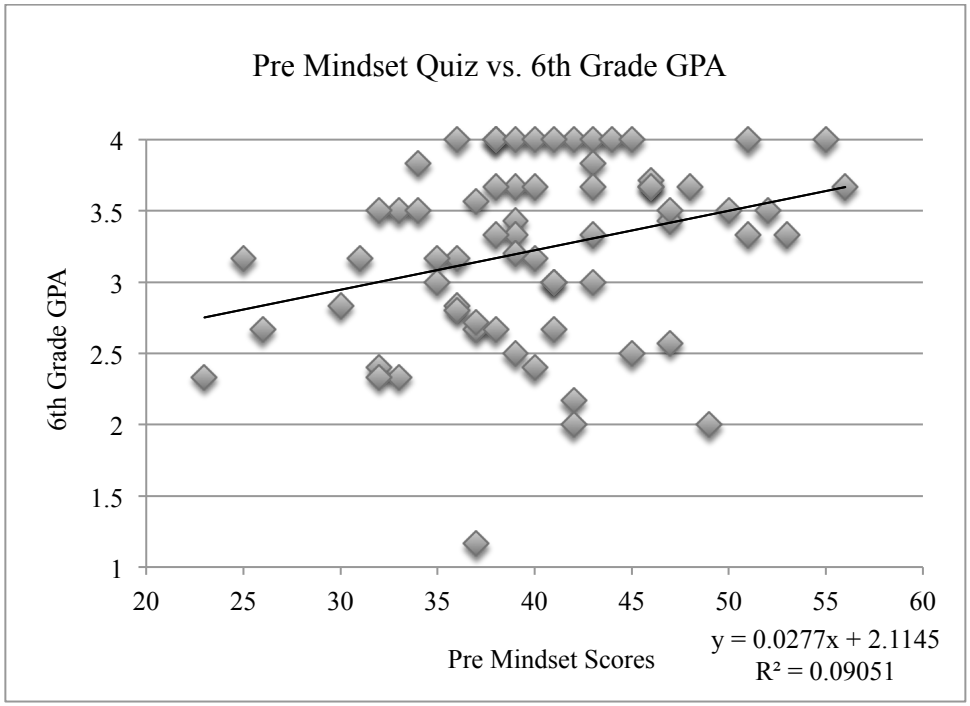

Figure 1. Pre mindset quiz score versus 6th grade GPA. As mindset scores increased, GPA increased.

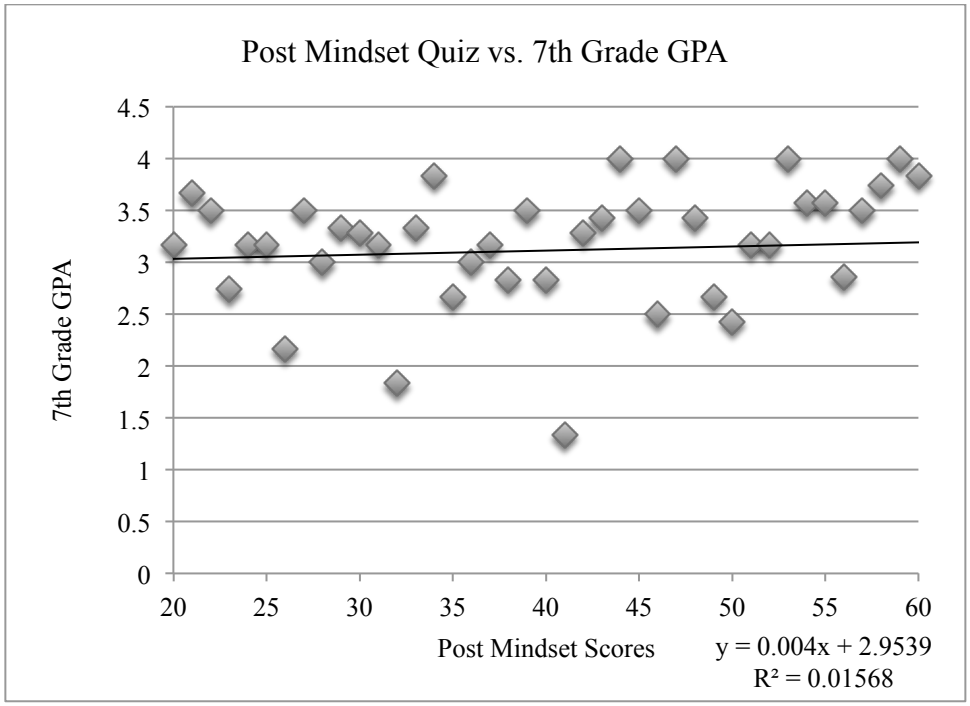

Figure 2. Post mindset quiz score versus 7th grade GPA. As mindset scores increased, GPA increased.

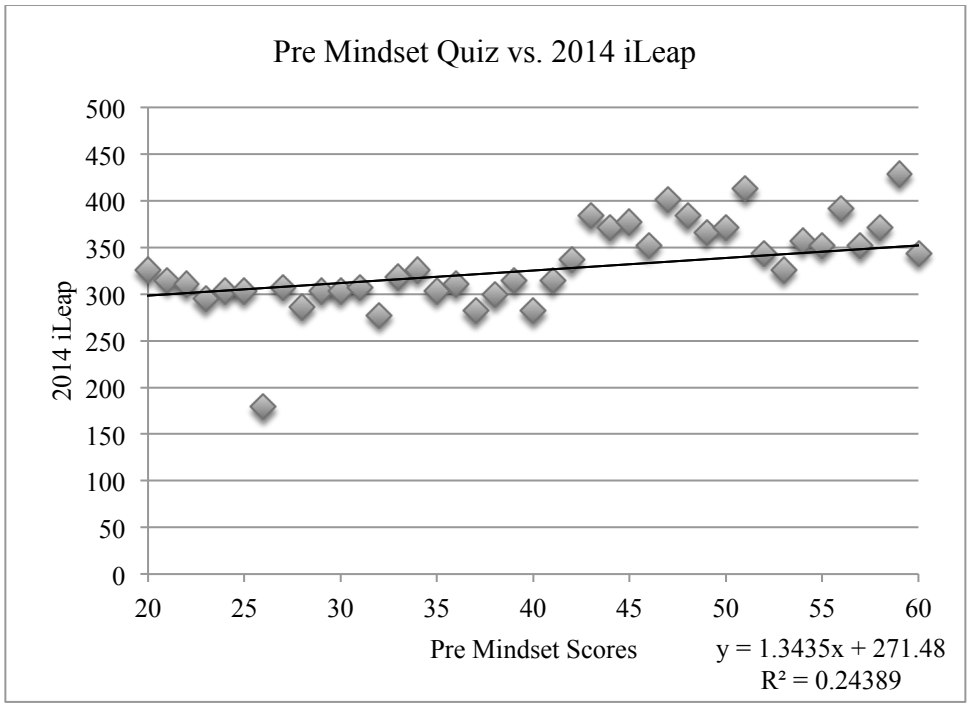

Figure 3. Pre mindset quiz score versus 2014 iLEAP scores. As mindset scores increased, iLEAP Scores increased.

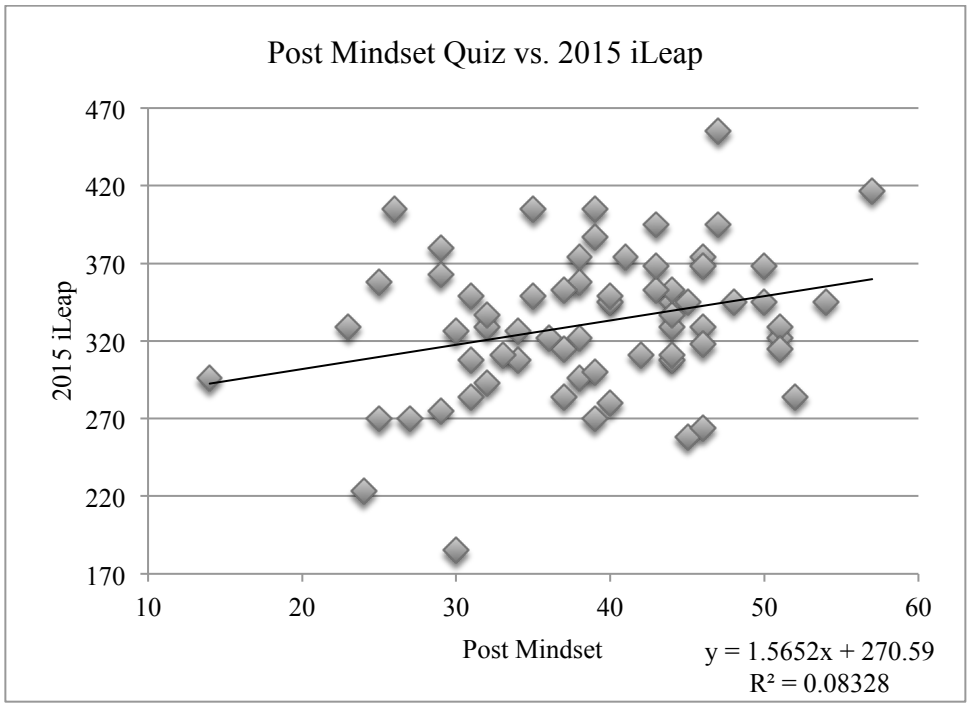

Figure 4. Post mindset quiz score versus 2015 iLEAP scores. As mindset scores increased, iLEAP scores increased.

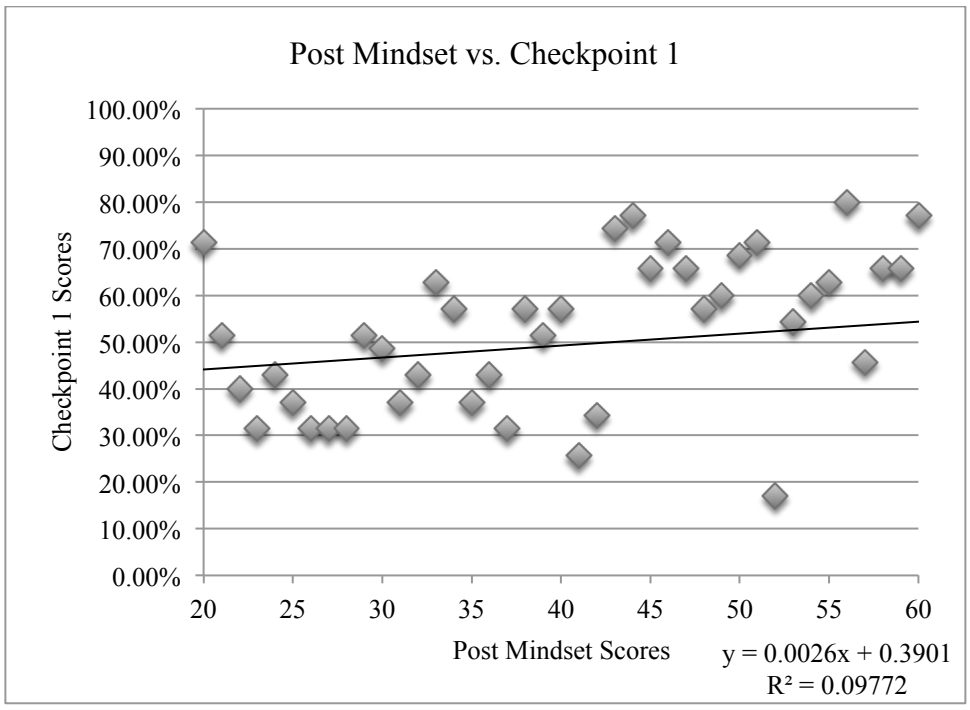

Figure 5. Post mindset quiz score versus district checkpoint 1 scores. As post mindset scores increased, checkpoint 1 scores increased.

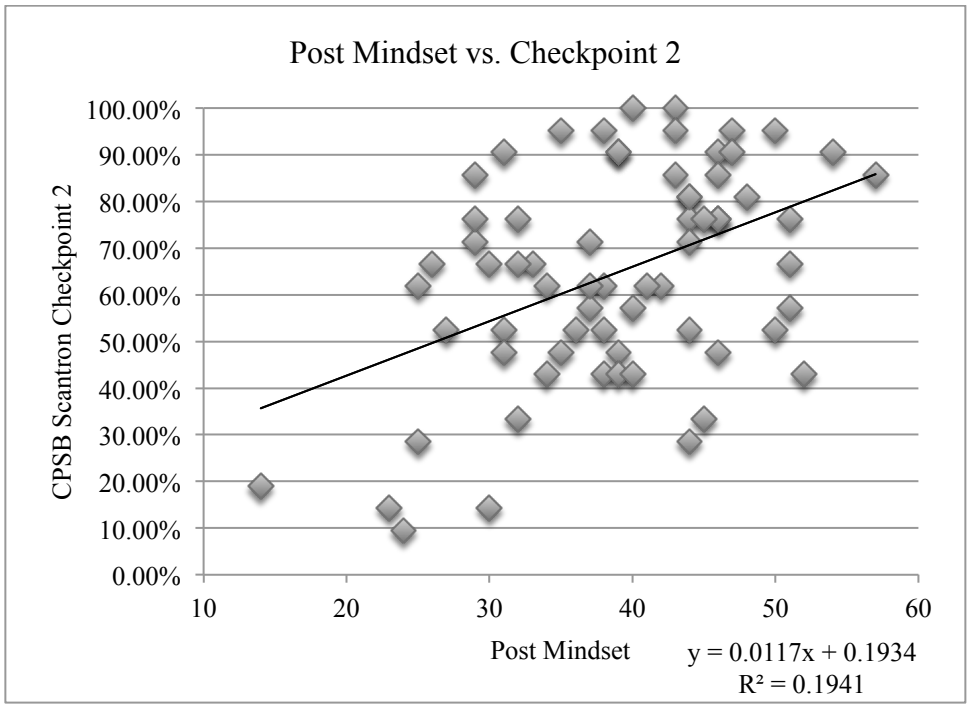

Figure 6. Post mindset quiz score versus district checkpoint 2 scores. As post mindset scores increased, checkpoint 2 scores increased.

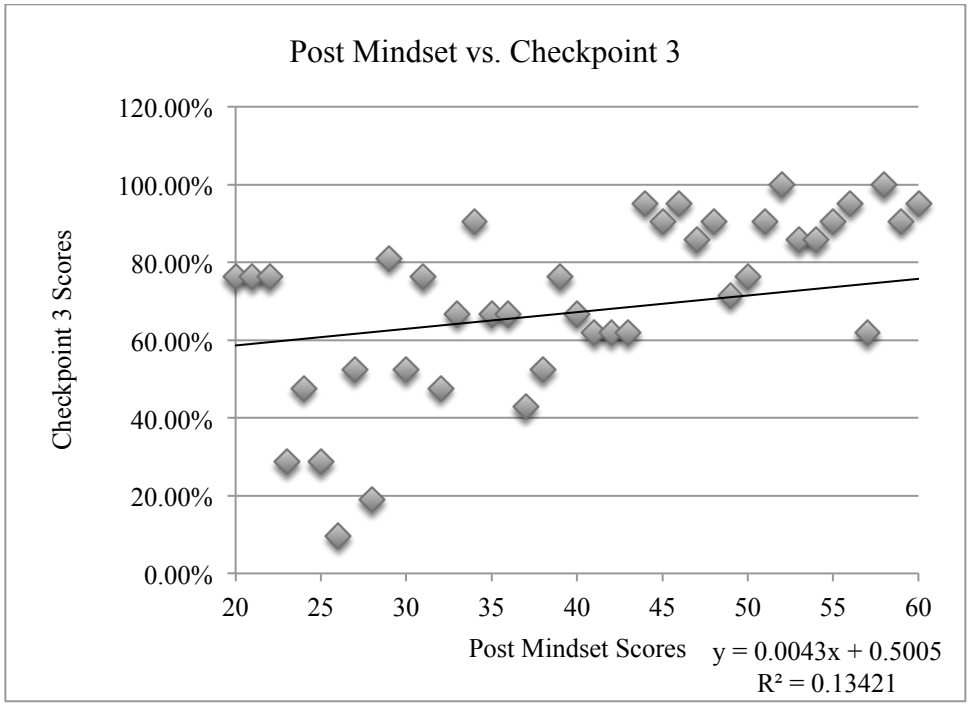

Figure 7. Post mindset quiz score versus district checkpoint 3 scores. As post mindset scores increased, checkpoint 3 scores increased.

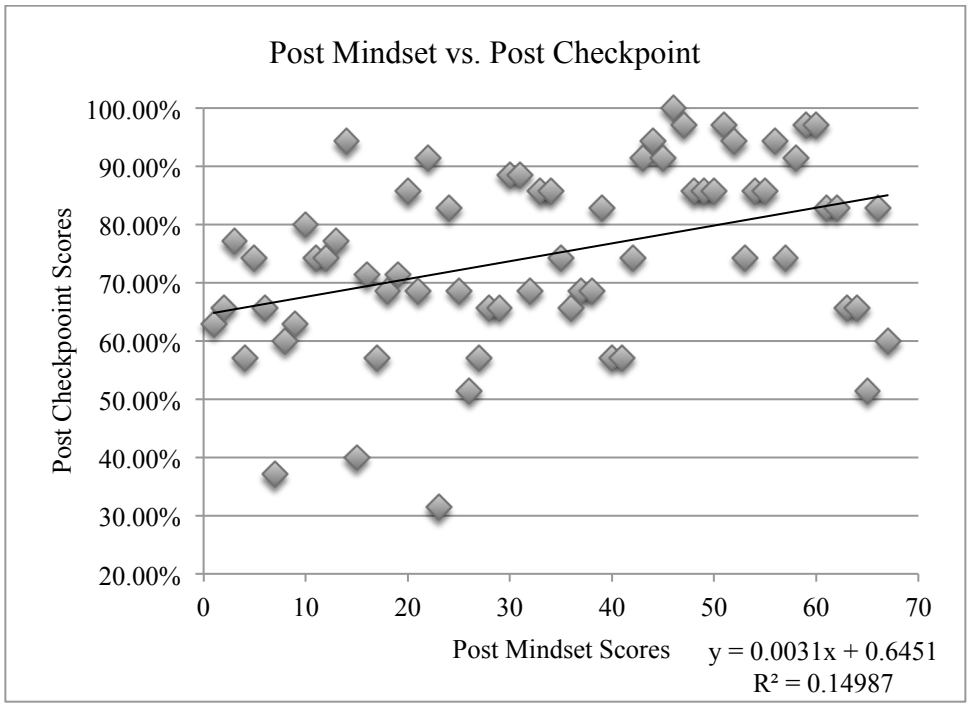

Figure 8. Post mindset quiz score versus the district post checkpoint scores. As post mindset scores increased, post checkpoint scores increased.

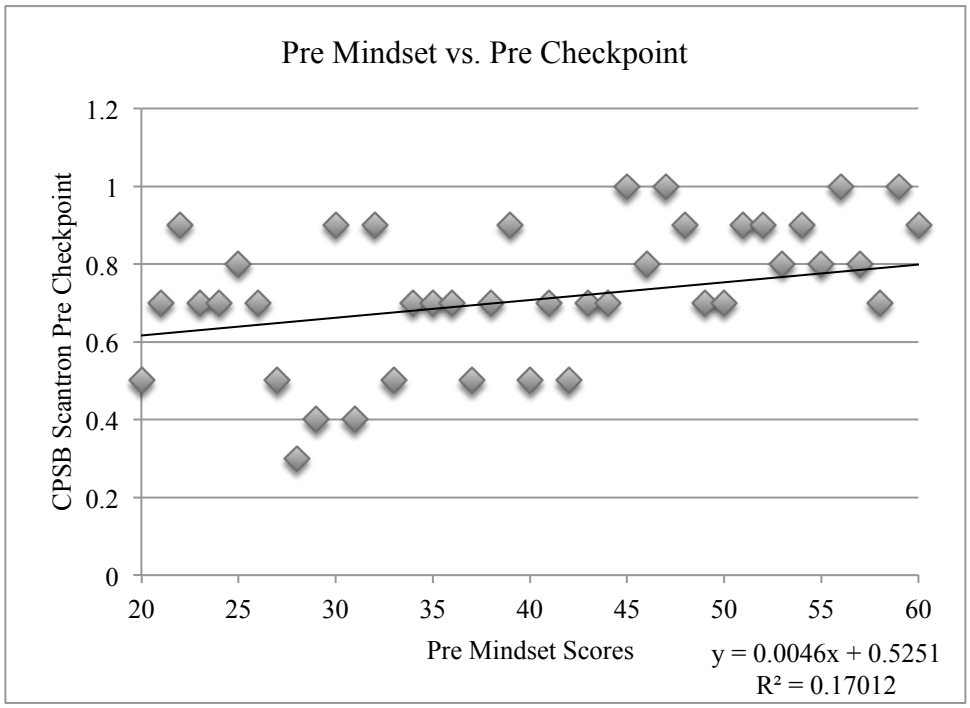

Figure 9. Pre mindset quiz scores versus pre district checkpoint scores. There was no significant correlation.

SUMMARY AND CONCLUSION

For the entire study sample, the average mindset category was a growth mindset with some fixed ideas. This was good news. The scores indicated that the students already had a positive outlook on life, and some guidance on mindset might nudge them in the right direction. The control group consisted of two regular classes and one gifted class, while the experimental group consisted of three regular classes. I thought inclusion of the gifted class in the control group might affect the averages, causing the control group's mindset to be higher, but it didn't. Pre mindset quiz averages for the control and experimental group were close to the same, showing no significant difference. The groups started in the same mindset category. Even when the gifted class data were removed from the pre mindset quiz data set, the control group still remained in the growth mindset with some fixed ideas category, with no difference between the control group and the experimental group.

There were similar results for the Science Attitude Survey and the Competency in Science Survey. The scores for the pre survey and pre inventory were similar for the control and experimental groups. This meant, as a whole group, the students' attitudes about science, and how competent they felt in science, were similar. The highest possible score for the Science Attitude Survey was 36, and the average was 23.05 for the control group and 21.72 for the experimental group. The highest possible score for the Competency in Science Survey was 33, and the average was 20.24 for the control group and 19.64 for the experimental group. Both groups had room to improve in both their attitude and view of their competency in science. When the gifted class data were removed from the Science Attitude Survey data and the Competency in Science Survey data, the scores were still similar. The pre Science Attitude Survey went down from 23.05 to 21.61, and the pre Competency in Science Survey data went down from 20.24 to 17.96 for the control group when the gifted class data were removed. The experimental group stayed the same since the gifted class was only included in the control group. Removing the control group from the data sets brought the averages even closer to the experimental group's averages for the Science Attitude Survey (21.72) and the Competency in Science Survey (16.64).

There were significant differences where the control group originally scored higher than the experimental group in three areas: the pre district checkpoint, the 2014 Grade 6 iLEAP, and 6th grade GPA. Each of these tools reflects academic and comprehensive success in life science. The control group started out higher in these areas, because the gifted class was included. The gifted class consistently outscored all of the other classes for the entire school year on content assessments. When the gifted class data were removed from the pre district checkpoint

scores, 2014 iLEAP scores and 6th grade GPA there were no differences between the control group and the experimental group.

The goal of this study was to see if a mindset intervention, the growth conferences, would cause an increase in the experimental group's mindset, Science Attitude Surveys, Competency in Science Surveys and academics, such as the checkpoints, 2015 iLEAP, and GPA compared to the control group. Post mindset scores were not significantly different from one another for the control group and the experimental group, and their averages for the mindset category both remained in the growth mindset with some fixed ideas category. The post Science Attitude Surveys and the Competency in Science Survey also showed no significant difference between the control group and the experimental group. These findings were the same when the gifted class data were removed from the posttests data sets.

The posttest scores that did show a significant difference between the control group and the experimental group were the 2015 iLEAP scores and the post district checkpoint scores. The control group averaged significantly higher than the experimental group. The most likely reason for this is that the control group contained the only gifted class. This class scored consistently higher on the iLEAP and district checkpoints previously. When the gifted class data were removed from the post district checkpoint scores and the 2015 iLEAP scores, there were no differences between the control group and the experimental group.

After comparing the scores of the pre tests for the control group and the experimental group, and the posttests for the control group and the experimental group, the pre and posttests for the experimental group were compared. The pre and post mindset quizzes for the experimental group did not show any significant difference. The averages for both the pre and post mindset quizzes did remain in the growth mindset with some fixed ideas category. The pre and post Science Attitude Survey and Competency in Science Survey also did not show any significant difference. Overall, the growth conferences did not have an effect on the experimental group as a whole according to these measures.

There was a significant difference between all of the mean district checkpoints for the experimental group and the control group. The mean district checkpoint scores decreased throughout the school year for the control and experimental group then increased for the post checkpoint. The reason for this trend was the increasing difficulty of the checkpoints throughout the school year. The post checkpoint was high stakes for the teachers and the students, so the students also took the posttest more seriously. The control group continually scored higher than the

experimental group on the checkpoints. The control group's mean grew 26.88 percentage points and the experimental group's mean grew 27.77 percentage points from the pretest to the posttest. Their growth was about the same. When the gifted class data were removed from the all of district checkpoint scores, there were no differences between the control and the experimental group. There were no differences between the two group's checkpoint scores that could be attributed to the mindset intervention.

The only content based area where the control group did not score higher than the experimental group was 7th grade GPA. The control group's GPA actually decreased significantly from 2014 to 2015, bringing the control group's GPA closer to the experimental group's GPA for 2015. The experimental group's GPA stayed the same from 2014 to 2015. There was no difference between the control and experimental group's GPA for 2015. When the gifted class was removed from the control group, there was no difference between the 2014 and 2015 GPA, so the original decrease had a lot to do with the gifted class. This finding was surprising. It is possible that the experimental group was affected by the study, so that their GPA didn't decrease like the control group's GPA did. And the gifted students' fixed ideas may have caused their scores to decrease, as their classes became more challenging.

Analysis of individual student mindset scores (increased, stayed the same, or decreased) indicated that more students' mindset scores decreased during the semester than increased in both the control group and the experimental group than increased or stayed the same. Out of the entire study sample 53.73 % of the students' mindset quiz scores decreased from the pretest to posttest, 41.79 % increased, and 4.478 % stayed the same. Seventh grade is a difficult year for students (Blackwell et al. 2007, Dweck, 2008). They are dealing with a multitude of factors that can affect their mindset, such as:

- Social pressures
- Puberty
- Home life/upbringing
- Bullying
- Socioeconomics
- Poverty, etc.

All of this suggests that a much more rigorous intervention needs to be in place to impact the students' mindset, especially at this age (Blackwell et al. 2007, Dweck, 2008).

I also took a look at students whose mindset scores increased significantly. These students grew at least four points on the mindset quiz scale, and many of them moved up a category on the scale. A total of seventeen students made the list; seven students from the experimental group, and eleven students from the control group. Participating in the study may have helped a few of these students. Taking the mindset quiz and completing the cognitive wrappers also may have been enough exposure for some students in the control group to catch on, reflect on their mindset, and benefit from the study. Based on the work ethic and attitude of these individual students, these results make sense. These students were some of the most focused, aware, and positive students on a daily basis.

At the end of the study, I asked all students four questions to look at the relationship between their mindset and their answers. The questions were derived from Dweck's book, "Mindsets: The New Pshycology of Success" (2006). The four questions were: What does it mean to be a successful student? How do you feel when you get a bad grade? Would you ever cheat on a test? And do you think you could successfully invent something?

One student from the experimental group whose mindset score decreased from 36-32 moved from growth mindset with fixed ideas to fixed mindset with some growth ideas. His answers to the questions were:

1. What does it mean to be a successful student?
   - Be yourself, and tell what you know.
2. How do you feel when you get a bad grade?
   - Man, I gotta' pick that up.
3. Would you ever cheat on a test?
   - Yes, tests are hard nowadays.
4. Do you think you could successfully invent something?
   - Somewhat.

A student from the control group who decreased from 37-33 moved from growth mindset with fixed ideas to fixed mindset with some growth ideas. His answers to the questions were:

1. What does it mean to be a successful student?
   - It feels good knowing that I'm gonna' pass.
2. How do you feel when you get a bad grade?
   - It makes me want to study more.
3. Would you ever cheat on a test?
   - Yes, I have so I could make a good grade and so I wouldn't get in trouble.
4. Do you think you could successfully invent something?
   - No cause' there is nothing to really create when most of it has already been created.

A student from the experimental group whose mindset score increased from 39-44, which kept them in the growth mindset with fixed ideas category, answered:

1. What does it mean to be a successful student?
   - In my eyes it means trying your best on everything no matter how small.
2. How do you feel when you get a bad grade?
   - At first, I am a little sad, but then I realize I try my best. So, I need to try harder next time.
3. Would you ever cheat on a test?
   - No, because I didn't work my hardest, doesn't mean I should use someone else's work.
4. Do you think you could successfully invent something?
   - Yes, if I set my mind to it!

A student from the control group who increased from 42-57 moved from growth mindset with fixed ideas to strong growth mindset. Her answers to the questions were:

1. What does it mean to be a successful student?
   - To be a successful student, you must study hard at anything your teacher assigns you. You must do all homework and don't make excuses for not doing it. Obey and respect the teacher's authority.
2. How do you feel when you get a bad grade?
   - I feel I can do better and try to stay on top of my work as much as I can to make it better.
3. Would you ever cheat on a test?
   - I'll never cheat. That's a stupid decision too many students choose.
4. Do you think you could successfully invent something?
   - I feel I can do anything once I put my mind to it.

There are clear differences in the students' answers that align with their mindset. This insight is important for teachers and students, because it lets the student know more about how they view the world, helps them to reflect, motivates them to improve, gives teachers an idea of where behaviors stem from, and is a starting place for individual intervention. These questions can be given at the beginning of the school year. Student's who give negative answers could be targeted for mindset intervention.

During the study I met with students for growth conferences three times throughout the fall semester. I attribute the lack of a change in the mindsets of the students in the experimental group to the minimal time I actually spent counseling each student. To redesign the study, I would try a weekly whole group intervention, instead of one on one, where students would have to write down their responses to the questions:

- What are three of your strengths in your life science course?
- What are three of your weaknesses in your life science course?
- What three specific things will do to improve your test grades and/or how you prepare for class?

With this design, students would get many more opportunities to reflect on their mindset and their growth throughout the semester.

In "Mindsets and Math/Science Achievement", Dweck (2008) presented research that showed:

- mindsets can predict math/science achievement over time;
- mindsets can contribute to math/science achievement discrepancies for women and minorities;
- interventions that change mindsets can boost achievement and reduce achievement discrepancies; and
- educators play a key role in shaping students' mindsets.

Similar to Dweck's research, I found that there were positive correlations between mindset and 6th grade GPA, mindset and 7th grade GPA, mindset and 2014 iLEAP scores, mindset and 2015 iLEAP scores, mindset and checkpoint 1, mindset and checkpoint 2, mindset and checkpoint 3, and mindset and the post checkpoint scores (Blackwell et al. 2007, Dweck 2006, Dweck 2008, Grant et al. 2003). There was no correlation between mindset and the pre checkpoint. The pre checkpoint was given before the students learned the life science content. As the school year went on, having a higher mindset score did indicate higher achievement on the checkpoints.

This conclusion parrallels with the findings of Study 1 of "Implicit Thoeries of Intelligence Predict Achievement Across an Adolescent Transition: A Longitudinal Study and an Intervention" (Blackwell et al. 2007). Study 1 found that at the beginning of the school year, the students started out with similar grades. Over time, and more challenges, the math scores of the students with fixed mindsets decreased, while the math scores of the students with growth mindsets increased (Blackwell et al. 2007).

Grant and Dweck (2003) found similar results in "Clarrifying Achievement Goals and Their Impact". Organic chemistry students with a growth mindset achieved higher final grades than the students with a fixed mindset. In the present study, sixth grade GPA and 2014 iLEAP from the end of the previous year, and GPA and the

2015 iLEAP scores from the end of seventh grade also increased as mindset increased. As the school year passed, higher mindset scores indicated higher performance, and lower mindset scores indicated lower performance.

The decrease in GPA from 6th grade to 7th grade for the control group is the reason why the gifted students may need mindset intervention the most. The gifted, most intelligent students believe they are smart, but when they are challenged and defeated, they don't have a strategy to put in the effort and rise again. I was pleased to see that the experimental group's GPA did not decrease, but remained the same from 6th to 7th grade. The gap between the control group and experimental group was bridged by the decrease of the gifted class' scores. These findings support the previous, aforementioned research, and inspire me to continue experimenting to find mindset interventions that work.

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APPENDIX A: MINDSET QUIZZES

Mindset Quiz 1

To what extent do you agree or disagree with these statements:
Strongly Agree (SA) Agree (A) Disagree (D) Strongly Disagree (SD)

1. Your intelligence is something about you that you can't change very much. _____
2. You can always greatly change how intelligent you are. _____
3. You are a certain type of person, and there is not much that can be done to change that. _____
4. You can always change basic things about the type of person you are. _____
5. Music talent can be learned by anyone. _____
6. Only a few people will be truly good at sports – you have to be "born with it." _____
7. Math is much easier to learn if you are male or if you come from a culture that values math. _____
8. The harder you work at something, the better you will be at it. _____
9. No matter what type of person you are, you can always change. _____
10. No matter how much intelligent you are, you can always change it. _____

Mindset Quiz 2

To what extent do you agree or disagree with these statements:
Strongly Agree (SA) Agree (A) Disagree (D) Strongly Disagree (SD)

1. Trying new things is stressful for me and I avoid it. _____
2. Some people are good and kind, and some are not – it's not often that people change. _____
3. I appreciate when people, parents, coaches, teachers give me feedback about my performance. _____
4. I often get angry when I get feedback about my performance. _____
5. All people without a brain injury or birth defect are capable of the same amount of learning. _____
6. You can learn new things, but you can't change how intelligent you are. _____
7. You can do things differently, but the important parts of who you are can't be changed. _____
8. Human beings are basically good, but sometimes make bad decisions. _____
9. An important reason why I do my schoolwork is that I like to learn new things. _____

10. Smart people do not need to try hard. _____

Key
1. ability mindset – fixed
2. ability mindset –growth
3. ability mindset – growth
4. personality/character mindset - fixed
5. personality/character mindset – growth
6. ability mindset – growth
7. ability mindset – fixed
8. ability mindset – fixed
9. ability mindset – growth
10. personality/character mindset - growth
11. ability mindset – fixed
12. personality/character mindset – fixed
13. ability mindset –growth
14. ability mindset – fixed
15. ability mindset – growth
16. ability mindset – fixed
17. personality/character mindset – fixed
18. personality/character mindset –growth
19. ability mindset – growth
20. ability mindset – fixed

Scoring

Growth Questions
1. Strongly agree – 3 points
2. Agree – 2 points
3. Disagree – 1 point
4. Strongly disagree – 0 point

Fixed Questions
1. Strongly agree – 0 point
2. Agree – 1 point
3. Disagree – 2 points
4. Strongly disagree – 3 points

Strong Growth Mindset = 60-45 points
Growth Mindset with some Fixed ideas = 44-34 points
Fixed Mindset with some Growth ideas= 33-21 points
Strong Fixed Mindset= 20-0 points

Adapted from:
Dweck, C. S. (2006). Mindset: The new psychology of success. New York: Random House Inc.

APPENDIX B: COGNITIVE WRAPPERS

Life Science Test Wrapper

This activity is designed to help you reflect on your score and, more importantly, on the effectiveness of your exam preparation. Please answer the questions sincerely. Your response will be collected to inform Mrs. Gauthreaux about your experiences with this test, and how she can best support your learning and growth.

Name _____
Test _____
Date _____
Hour_____

1. Approximately how much time did you spend preparing for the test? _____

2. What percentage of your test-preparation time was spent in each of these activities?
    a. Reading the sections in the book for the first time _____
    b. Re-reading the sections from the book _____
    c. Re-reading the material (worksheets, articles, any extra material) _____
    d. Reviewing your own notes _____
    e. Working practice test questions _____
    f. Reviewing materials from Blackboard _____
    g. Studying with a friend or friends _____
    h. Other _____ _____

3. Now that you have looked over your grade, estimate the percentage of points you lost due to each of the following (make sure percentages add up to 100):
    a. Trouble with applying definitions _____
    b. Trouble remembering diagrams, pictures, or structures _____
    c. Lack of understanding of the concepts _____
    d. Unclear expectation in directions _____
    e. Not knowing how to approach a problem _____
    f. Carless mistakes _____
    g. Other _____ _____

4. Based on your responses above, name at least 3 things you will do differently in preparing for the next exam. For example, will you just spend more time, change a specific study habit or try a new one (if so, name it), try to sharpen some other skill (if so, name it), seek help, participate more in review opportunities, something else?

5. What can Mrs. Gauthreaux do to help support your learning, preparation, and growth for the next test?

PLEASE CONTINUE ON THE BACK ON ANY QUESTION WHERE YOU NEED MORE ROOM.

Life Science Preparedness Wrapper

This activity is designed to help you reflect on your score and, more importantly, on the effectiveness of your exam preparation. Please answer the questions sincerely. Your response will be collected to inform Mrs. Gauthreaux about your experiences with this test, and how she can best support your learning and growth.

Name _____
Test _____
Date _____
Hour_____

1. Approximately how much time did you spend preparing for class today? _____

2. What percentage of your class preparation time was spent in each of these activities?
   a. Reading the sections in the book for the first time _____
   b. Re-reading the sections from the book _____
   c. Re-reading the material (worksheets, articles, any extra material) _____
   d. Reviewing your own notes _____
   e. Working practice questions _____
   f. Reviewing materials from Blackboard _____
   g. Preparing with a friend or friends _____
   h. Other _____ _____

3. Estimate the percentage of mistakes you made in each area (make sure percentages add up to 100):
   a. Trouble with applying definitions _____
   b. Trouble remembering diagrams, pictures, or structures _____
   c. Lack of understanding of the concepts _____
   d. Unclear expectation in directions _____
   e. Not knowing how to approach a problem _____
   f. Carless mistakes _____
   g. Other _____ _____

4. Based on your responses above, name at least 3 things you will do differently in preparing for the next class. For example, will you just spend more time, change a specific habit or try a new one (if so, name it), try to sharpen some other skill (if so, name it), seek help, participate more, something else? What aspect(s) of your preparation for this class seemed different from your previous class preparation? Did these changes have any effect?

5. What can Mrs. Gauthreaux do to help support your learning, preparation, and growth for the next class?

PLEASE CONTINUE ON THE BACK ON ANY QUESTION WHERE YOU NEED MORE ROOM.

APPENDIX C: SURVEYS

Science Attitude Survey

Instructions:
The following statements are about the study of science. Please read each statement carefully and decide whether it describes the way you feel about science. *Then, select the appropriate response.* Please respond to every statement. Remember, this is not a test. Simply respond to each statement according the to way you feel right now.

Rating Scale:
0=Strongly Disagree
1=Disagree
2=Agree
3=Strongly Agree

Items:
1. Science is useful for the problems of everyday life.
2. I would like to do some outside reading in science.
3. Most people should study some science.
4. Sometimes I read ahead in my science book.
5. Science is of great importance to a country's development.
6. You can get along perfectly well in everyday life without science.
7. It is important to me the understand the work I do in science.
8. I have a real desire to learn science.
9. I enjoy talking to other people about science.
10. Sometimes I do more science problems than are given in class.
11. Science is something which I enjoy very much.
12. Science is helpful in helping in understanding today's world.

Competency in Science Survey

Instructions:
I'd like to know how good of a scientist you are! Please select the response that tells how much you currently can use each of the following skills when you work on a science investigation.

Rating Scale:
0=Never
1=Sometimes
2=Usually
3=Always

Items:
1. I can use scientific knowledge to form a question.
2. I can ask a question that can be answered by collecting data.
3. I can design a scientific procedure to answer a question.
4. I can communicate a scientific procedure to others.
5. I can record data accurately.
6. I can use data to create a graph for presentation to others.
7. I can create a display to communicate my data and observations.
8. I can analyze the results of a scientific investigation.
9. I can use science terms to share my results.
10. I can use models to explain my results.
11. I can use the results of my investigation to answer the question that I asked.

APPENDIX D: GRADE 7 RELEASED ILEAP QUESTIONS

Grade 7 Science iLEAP Released Questions

Sample Test Items by Strand- Grade 7 Science

Science as Inquiry
The Abilities Necessary to Do Scientific Inquiry
GLE 2— *Identify problems, factors, and questions that must be considered in a scientific investigation (SI-M-A1)*

1. A scientist studied a species of fish. She found that when a certain nutrient was added to the diet of the fish just after hatching, the fish gained an average of 3 kilograms in the first year. What additional information is needed to determine whether the nutrient is affecting the growth of the fish?

A. how much adult fish gained on average when the same nutrient was added to their diet
B. how much newly hatched fish in this species gain in the first year without the nutrient in their diet
C. how much of the nutrient is available for the fish species in their natural surroundings
D. how much other species of fish gain in the first year when the nutrient is added to their diet

Correct Response: B

Science as Inquiry - The Abilities Necessary to Do Scientific Inquiry
GLE 22—*Use evidence and observations to explain and communicate the results of investigations*

2. A scientist discovers that a certain substance will be useful in treating nerve damage. What is the best way she can communicate her results to the scientific
community?

A. She can call other scientists who also work in nerve research.
B. She can write a letter to hospitals that treat patients with nerve damage.
C. She can put her conclusions on a Web site that focuses on the nervous system.
D. She can publish her results in a scientific journal that covers issues relating to nerves.

Correct Response: D

Science as Inquiry - Understanding Scientific Inquiry
GLE 27—*Recognize that science uses processes that involve a logical and empirical, but flexible, approach to problem solving*

3. Leslie's science teacher told her she must take a flexible approach to solving problems. What did Leslie's teacher most likely mean?

A. Leslie should not follow the experimental instructions exactly.
B. Leslie should only write down lab results that seem to be correct.
C. Leslie should accept all scientific theories even if they have been proven wrong.
D. Leslie should be willing to consider many possible causes for her observations.

Correct Response: D

Science as Inquiry - Understanding Scientific Inquiry
GLE 28—*Recognize that investigations generally begin with a review of the work of others*

4. A scientist plans to investigate the nervous system of sea slugs. What should the scientist do first?

A. Develop a theory about sea slugs that can be tested.
B. Go to the ocean to observe the behavior of sea slugs.
C. Obtain several sea slugs and conduct experiments with them.
D. Review the research other scientists have done on sea slugs.

Correct Response: D

Science as Inquiry - Understanding Scientific Inquiry
GLE 30—*Describe why all questions cannot be answered with present technologies*

5. Researchers recently discovered a gene in humans that previously was unknown to science. Which statement best explains why the gene probably was not
discovered much sooner?

A. The gene only recently evolved in humans.
B. The technology used to study genes is still being developed.
C. Scientists were not interested in genes until a few years ago.
D. Scientists were sure they had already discovered every possible gene.

Correct Response: B

Science as Inquiry - Understanding Scientific Inquiry
GLE 32—*Explain the use of statistical methods to confirm the significance of data (e.g., mean, median, mode, range)*

6. A scientist studied the number of eggs a species of bird lays each year. He found that the most common number of eggs laid in a year is three. Which statistical measurement did the scientist find?

A. the mean number of eggs laid in a year
B. the median number of eggs laid in a year
C. the mode of the number of eggs laid in a year
D. the range of the number of eggs laid in a year

Correct Response: C

Science as Inquiry
Understanding Scientific Inquiry
GLE 35—*Explain how skepticism about accepted scientific explanations (i.e., hypotheses and theories) leads to new understanding (SI-M-B5)*

7. Joanne's science teacher cautioned the class to be skeptical when learning about new scientific discoveries. Why is it important to be skeptical about new
discoveries in science?

A. because many scientific discoveries are not based on facts
B. because most scientific discoveries have no scientific value
C. because most scientists make errors when formulating scientific discoveries
D. because all scientific discoveries must be examined critically before they can be accepted

Correct Response: D

Science as Inquiry - Understanding Scientific Inquiry
GLE 40—*Evaluate the impact of research on scientific thought, society, and the environment*

8. Louis Pasteur discovered that the bacteria in a substance can be killed by heating the substance for a short period of time. Which of these practices benefited most from Pasteur's discovery?

A. storing foods for longer periods of time
B. building ovens and other heating devices
C. creating medicines that cure infections
D. transporting living organisms without injuring them

Correct Response: A

Life Science - Structure and Function in Living Systems
GLE 3—*Illustrate and demonstrate osmosis and diffusion in cells*

9. In which situation would osmosis most likely occur in cells?

A. across a permeable membrane that separates solutions of the same concentration
B. across a permeable membrane that separates solutions of different concentrations
C. across a nonpermeable membrane that separates solutions of the same concentration
D. across a nonpermeable membrane that separates solutions of different concentrations

Correct Response: B

Life Science - Structure and Function in Living Systems
GLE 7—*Construct a word equation that illustrates the processes of photosynthesis and respiration*

10. Which statement best describes the process of respiration?

A. Oxygen and sugar are used in the process that provides energy to cells; water and carbon dioxide are its waste products.
B. Water and sugar are used to in the process that provides energy to cells; oxygen and carbon dioxide are its waste products.
C. Oxygen and carbon dioxide are used in the process that provides energy to cells; sugar and water are its waste products.
D. Carbon dioxide and sugar are used in the process that provides energy to cells; water and oxygen are its waste products.

Correct Response: A

Life Science - Reproduction and Heredity
GLE 15—*Contrast the processes of mitosis and meiosis in relation to growth, repair, reproduction, and heredity*

11. What is a difference between mitosis and meiosis?

A. Mitosis occurs in all the cells in animals and plants, while meiosis occurs in only in bacteria.
B. In mitosis, the products are identical to the parent cell, while in meiosis the products are different from the parent cell.
C. In mitosis, one cell divides into two cells, while in meiosis two cells combine to make one cell.
D. Mitosis involves separating the chromosomes, while meiosis involves only the cytoplasm of the cell.

Correct Response: B

Life Science - Reproduction and Heredity
GLE 17—*Explain the relationship of genes to chromosomes and genotypes to phenotypes*

12. In humans, *B* is the allele for brown eyes and *b* is the allele for blue eyes. Two brothers both have brown eyes, but one of them has both the *B* and *b* alleles while the other only has *B* alleles. Which statement is true about the brothers?

A. They have the same genotype and phenotype.
B. They have different phenotypes and genotypes.
C. They have the same phenotype but different genotypes.
D. They have the same genotype but different phenotypes.

Correct Response: C

Life Science - Populations and Ecosystems
GLE 26—*Describe and compare the levels of organization of living things within an ecosystem*

13. What do scientists mean when they refer to a *population*?

A. all the organisms in an ecosystem
B. all the species that share similar anatomical features
C. all the animals that acquire resources through similar methods
D. all the interbreeding members of a certain species in an ecosystem

Correct Response: D

Life Science - Populations and Ecosystems
GLE 27—*Identify the various relationships among plants and animals (e.g., mutualistic, parasitic, producer/consumer)*

14. Which relationship is mutualistic?

A. an insect that lives and feeds on the body of an alligator
B. an ant that lives on a plant and defends the plant from other insects
C. a bird that migrates to follow the movements of the butterflies that it eats
D. a deer that eats one kind of plant, which allows another kind of plant to grow in its place

Correct Response: B

Life Science - Adaptations of Organisms
GLE 30—*Differentiate between structural and behavioral adaptations in a variety of organisms*

15. Which example describes a behavioral adaptation?

A. A bird builds its nest in the ash near a volcano.
B. A whale has the ability to hold its breath for 20 minutes.
C. A fox's hair is white in the winter and brown in the summer.
D. A monkey has long arms that allow it to swing from one branch to another.

Correct Response: A

Life Science - Adaptations of Organisms
GLE 32—*Describe changes that can occur in various ecosystems and relate the changes to the ability of an organism to survive*

16. A forest is flooded when a natural dam breaks, leaving the forest floor under two meters of water. Which animal is most affected by the flooding?

A. a crow
B. a rabbit
C. a squirrel
D. a butterfly

Correct Response: B

Science and the Environment
GLE 35—*Identify resources humans derive from ecosystems*

17. Which resource is most likely found in large amounts in forest ecosystems?

A. iron
B. wood
C. plastic
D. petroleum

Correct Response: B

Science and the Environment
GLE 37—*Identify and describe the effects of limiting factors on a given population*

18. In a large forest with many animals, there are only a small number of bears. Which of these most likely limits the population of bears in the forest?

A. supply of food
B. type of tree
C. predation by carnivores
D. amount of suitable shelter

Correct Response: A

Science and the Environment
GLE 41—*Describe the nitrogen cycle and explain why it is important for the survival of organisms*

19. What is the main reason humans need nitrogen to survive?

A. Nitrogen is used in respiration to generate energy.
B. Nitrogen is used in making the proteins in the body.
C. Nitrogen is used to help the body eliminate wastes.
D. Nitrogen is used by nerve cells to conduct impulses.

Correct Response: B

Science and the Environment
GLE 42—*Describe how photosynthesis and respiration relate to the carbon cycle*

20. Which statement best describes the roles of photosynthesis and respiration in the carbon cycle?

A. Respiration and photosynthesis both add carbon to the atmosphere.
B. Respiration and photosynthesis both remove carbon from the atmosphere.
C. Respiration adds carbon to the atmosphere, while photosynthesis removes carbon from the atmosphere.
D. Photosynthesis adds carbon to the atmosphere, while respiration removes carbon from the atmosphere.

Correct Response: C

APPENDIX E: LSU IRB APPROVAL

ACTION ON EXEMPTION APPROVAL REQUEST

Institutional Review Board
Dr. Dennis Landin, Chair
130 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.5983
irb@lsu.edu | lsu.edu/irb

TO: Erin Gauthreaux
Biological Sciences

FROM: Dennis Landin
Chair, Institutional Review Board

DATE: June 12, 2014
RE: **IRB#** E8818

TITLE: Effect of Specific Feedback on Growth Mindset and Student Achievement

New Protocol/Modification/Continuation: New Protocol

Review Date: 6/10/2014

Approved X **Disapproved**_____

Approval Date: 6/11/2014 **Approval Expiration Date:** 6/10/2017

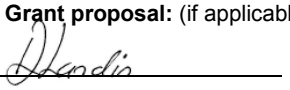
Exemption Category/Paragraph: 1

Signed Consent Waived?: No

Re-review frequency: (three years unless otherwise stated)

LSU Proposal Number (if applicable): ____

Protocol Matches Scope of Work in Grant proposal: (if applicable) _____

By: Dennis Landin, Chairman 

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –
Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. SPECIAL NOTE:

**All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/irb*

APPENDIX F: PARENTAL CONSENT FORM

Parental Permission

PROJECT TITLE: Effect of Specific Feedback on Mindset and Achievement

PERFORMANCE SITE: S.J. Welsh Middle School
1500 W McNeese St
Lake Charles, LA 70605

INVESTIGATORS: The following investigators are available for questions about this study,
Monday – Friday 9:00 a.m.- 3:00 p.m.
Mrs. Erin Gauthreaux 337-217-4410
Dr. E. William Wischusen 225-578-8239

PURPOSE OF THE STUDY: The purpose of this study is to determine whether there is an improvement in students' mindset and achievement at S. J. Welsh Middle School when using specific feedback during class and student teacher conferences.

INCLUSION CRITERIA: Students in 7th grade Life Science taught by Mrs. Erin Gauthreaux.

DESCRIPTION OF STUDY: Over the course of the 2014-2015 school year, the investigator will introduce students to a way of reflecting on and improving their learning. The teacher will use the students' reflections during student-teacher conferences to give students specific feedback on what they are doing well and what they can improve. The investigator will provide a quiz to measure each student's mindset and a pretest to measure each student's content knowledge. The investigator will precede by teaching students how to reflect on and improve their learning, and organizing conferences with the students that are in the experimental group. The control group will not participate in the conferences. At the end of the school year, students will be given the mindset quiz and a posttest.

BENEFITS: It is anticipated that all subjects will notice improved academic performance pertaining to students' abilities to grasp content knowledge and students' abilities to retain content presented. This study will also enhance behavior patterns within students, social capacity with teachers and peers, and an overall confidence of scientific knowledge by participating in this study.

RISKS: There are no risks with participation within this study.

RIGHT TO REFUSE: While participation in this study is highly suggested and recommended, it is not mandatory that a student subject choose to participate. At any time, either the subject may withdraw from the study or the subject's parent may withdraw the subject from the study. Non-participation in this study will leave no impact on the student's final grades or assessments throughout the duration of the school year.
PRIVACY: The records of participants in this study include, but are not limited to test scores and attendance, which may be reviewed by investigators. Also, results of the study may be published, but no names or other identifying information will be disclosed in publication. All subjects' identity will be kept confidential unless otherwise advised by law.

FINANCIAL INFORMATION: There is no cost for participation in this study, nor is there any compensation to the student subjects and/or their representatives for participation.

SIGNATURES: This study has been discussed with me and all of my questions have been answered. I may direct additional questions regarding study specifics to the primary and/or co-investigator. If I have questions about subjects' rights or other concerns I can contact Dr. Dennis Landin, Chairman of the Institutional Review Board at 225-578-8692, irb@lsu.edu | lsu.edu/irb. I will allow my child to participate in the study described above and acknowledge the investigator's obligation to provide me with a signed copy of this consent form.

Parent Signature_____ Date_____

IF APPLICABLE:
The parent/guardian has indicated to me that he/she is non-English speaking/reading, or unable to read. I certify that I have read and/or translated this consent form to the parent/guardian and explained that by completing the signature above, he/she has given permission for the child to participate in the study.

Signature of Reader_____Date_____

APPENDIX G: CHILD ASSENT FORM

Child Assent Form

I, _____, agree to be in a study that will help Mrs. Gauthreaux find ways to help educate students ate S. J. Welsh Middle School by using Scientific Learning Strategies. Mrs. Gauthreaux will provide ways to aid my knowledge of scientific content. I understand that I will have to work to the best of my abilities while in this study. I will devote my time towards this study by participating in all learning instruction, classroom, and at home activities, and assessments all while observing classroom rules at all times. I am fully aware that I can decide to stop being in the study at any time without getting in trouble or affecting my grade.

Student's Signature_____Age_____Date_____

Institutional Review Board
Dr. Dennis Landin, Chair
130 David Boyd Hall Baton Rouge, LA 70803
P: 225.578.8692 F: 225.578.5983
irb@lsu.edu | lsu.edu/irb

VITA

Erin F. Gauthreaux was born in Baton Rouge, Louisiana, in April 1989. She attended elementary and middle school at Sacred Heart of Jesus School in Baton Rouge, Louisiana and high school at St. John School in Plaquemine, Louisiana. She graduated from St. John High School in May 2007. The following August she entered college and in May 2011 earned a Bachelor's Degree from Louisiana State University Agricultural and Mechanical College. She entered the Graduate School at Louisiana State University Agricultural and Mechanical College in June 2013 and is a candidate for a Master of Natural Sciences. She is a middle school Life Science teacher in Calcasieu Parish and is currently teaching at S. J. Welsh Middle School.